

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

General Certificate of Secondary Education
Spring 2004



CHEMISTRY (MODULAR)
Aqueous and Organic Chemistry (Module 21)

346021

Wednesday 3 March 2004 Morning Session

In addition to this paper you will require:

- a black ball-point pen;
- an answer sheet.

You may use a calculator.

Time allowed: 30 minutes

Instructions

- Fill in the boxes at the top of this page.
- Check that your name, candidate number and centre number are printed on the separate answer sheet.
- Check that the separate answer sheet has the title “Aqueous and Organic Chemistry” printed on it.
- Attempt **one Tier only**, **either** the Foundation Tier **or** the Higher Tier.
- Make sure that you use the correct side of the separate answer sheet; the Foundation Tier is printed on one side and the Higher Tier on the other.
- Answer **all** the questions for the Tier you are attempting.
- Record your answers on the separate answer sheet only. Rough work may be done on the question paper.

Instructions for recording answers

- Use a **black ball-point pen**.

- For each answer **completely fill in the circle** as shown:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

- Do **not** extend beyond the circles.

- If you want to change your answer, **you must** cross out your original answer, as shown:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

- If you change your mind about an answer you have crossed out and now want to choose it, draw a ring around the cross as shown:

1	2	3	4
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

Information

- The maximum mark for this paper is 36.

Advice

- Do **not** choose more responses than you are asked to. You will lose marks if you do.
- Make sure that you hand in both your answer sheet and this question paper at the end of the test.
- If you start to answer on the wrong side of the answer sheet by mistake, make sure that you cross out **completely** the work that is not to be marked.

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Higher Tier starts on page 14 of this booklet.

FOUNDATION TIER

SECTION A

Questions **ONE** to **FIVE**.

In these questions match the words in the list with the numbers.

Use **each** answer only **once**.

Mark your choices on the answer sheet.

QUESTION ONE

This question is about soft and hard water.

Match words from the list with the numbers **1–4** in the sentences.

lather

scale

scum

soap

Soft water will easily form a **1** when shaken with one or two drops of soap solution.

When **2** is shaken with hard water, it reacts with dissolved chemicals to form a **3**

When hard water is boiled in a kettle, a layer of **4** often forms on the metal parts.

QUESTION TWO

This question is about four substances that can affect health.

Match words from the list with the numbers **1–4** in the table.

ammonium nitrate

calcium sulphate

carbon monoxide

ethanol

Substance	What we can say about the substance
1	it can have a harmful effect on babies if present in drinking water
2	it helps the body to develop strong teeth
3	it is present in alcoholic drinks and can be harmful in large quantities
4	it reduces the amount of oxygen that can be carried in the blood

QUESTION THREE

This question is about positive and negative ions.

Match ions **J**, **K**, **L** or **M** from the list with the numbers **1–4** in the sentences.

J Ca^{2+} ions

K H^+ ions

L $\text{H}^+(\text{aq})$ ions

M $\text{OH}^-(\text{aq})$ ions

Sulphuric acid can donate protons. Protons are **1**

In a solution of sulphuric acid, the protons are hydrated and can be represented as **2**

A solution of sodium hydroxide contains **3**

Water is hard if it contains **4**

Turn over ►

QUESTION FOUR

This question is about acids and alkalis.

Match words from the list with the numbers **1–4** in the table.

ammonia solution

ethanoic acid solution

sodium hydroxide solution

sulphuric acid solution

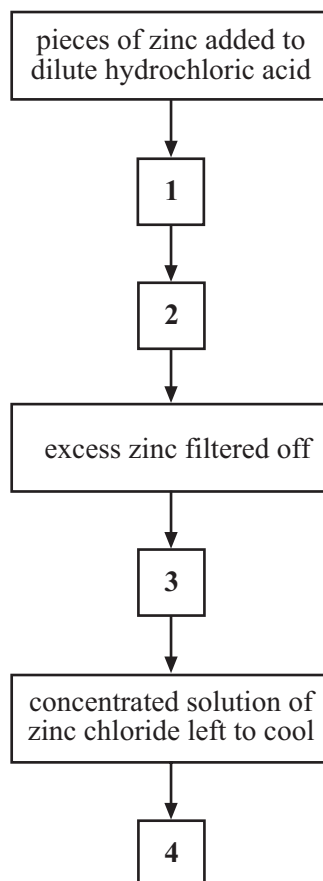
Solution	What we can say about the solution
1	it is a strong acid
2	it reacts with nitric acid to make ammonium nitrate
3	it is a strong alkali
4	it reacts only slowly with magnesium

QUESTION FIVE

The flow chart shows stages in the preparation of the salt, zinc chloride.

Match sentences **Q**, **R**, **S** or **T** from the list with the numbers **1–4**, to explain how the salt can be made.

- Q** bubbles of hydrogen gas start to be given off
- R** extra zinc pieces added until no more will react
- S** solid zinc chloride crystallises out
- T** some water evaporated from the solution of zinc chloride



TURN OVER FOR THE NEXT QUESTION

Turn over ►

SECTION BQuestions **SIX** and **SEVEN**.In these questions choose the best **two** answers.Do **not** choose more than two.Mark your choices on the answer sheet.

QUESTION SIX

This question is about wood as a fuel.

Which **two** of the following statements are correct?**carbon monoxide is produced when wood burns in plenty of air****one of the products when wood burns is water (vapour)****when wood burns, carbon dioxide is oxidised to carbon****wood contains carbon compounds****wood, like crude oil, is a compound****QUESTION SEVEN**

This question is about hard water.

Which **two** of the following statements are correct?**chlorine removes hardness from water****dissolved sodium compounds make water hard****drinking hard water can reduce heart illnesses****hard water can be softened in an ion exchange column****hard water can cause tooth decay**

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

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SECTION CQuestions **EIGHT** to **TEN**.

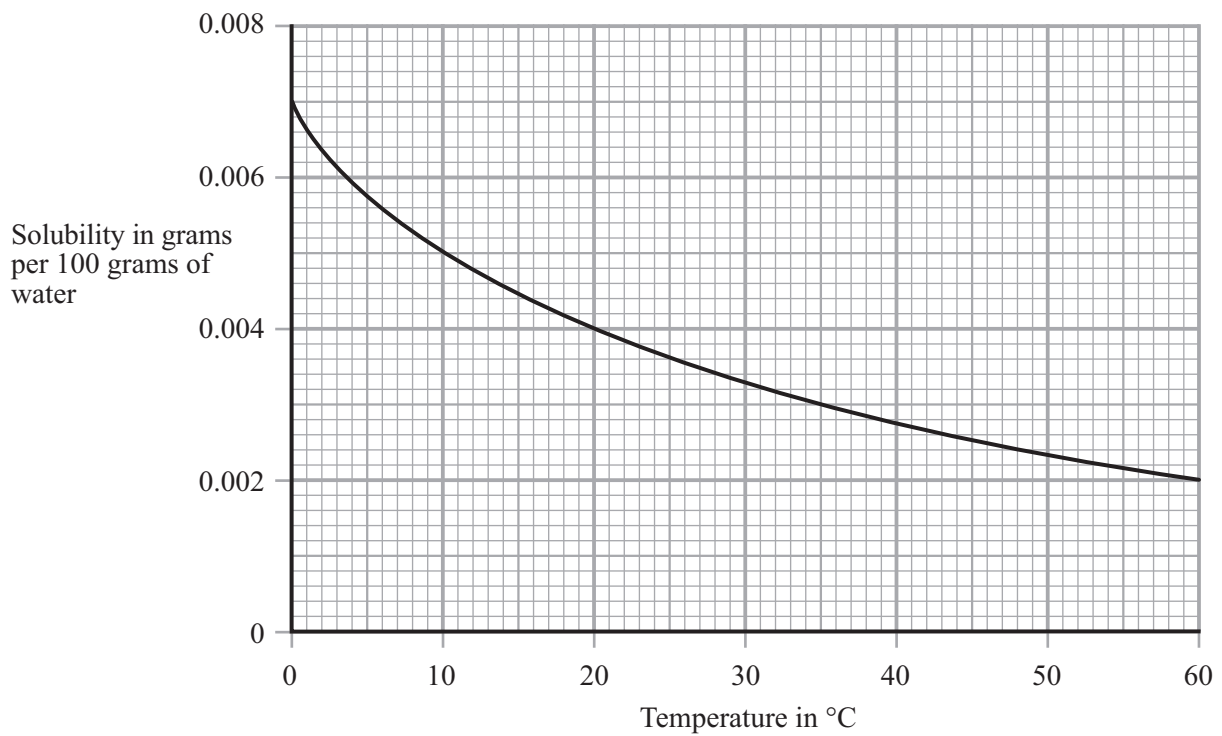
Each of these questions has four parts.

In each part choose only **one** answer.

Mark your choices on the answer sheet.

QUESTION EIGHT

The graph shows the solubility of oxygen in water for the temperature range from 0 °C to 60 °C

**8.1** What mass of oxygen will dissolve in 100 grams of water at 60 °C?**A** 0.0002 g**B** 0.002 g**C** 0.02 g**D** 0.20 g

8.2 How much more oxygen dissolves in 100 grams of water at 10 °C than at 20 °C?

- A 0.001 g
- B 0.002 g
- C 0.003 g
- D 0.004 g

8.3 100 grams of water are saturated with oxygen at 0 °C.

The temperature of the water is raised to 20 °C.

What mass of oxygen will be lost from the water?

- A 0.003 g
- B 0.004 g
- C 0.007 g
- D 0.011 g

8.4 1000 grams of water at 20 °C, in a container, are saturated with oxygen.

How can the amount of dissolved oxygen be increased?

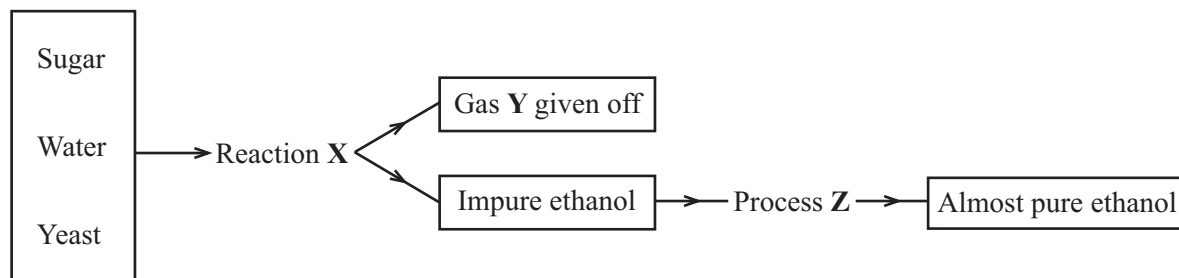
- A Increase the pressure
- B Increase the temperature
- C Put pure oxygen into the container and shake
- D Stir the water

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION NINE

The flow diagram shows how we can make ethanol.



9.1 Reaction **X** is called

- A carbonation.
- B condensation.
- C fermentation.
- D neutralisation.

9.2 The yeast works on the sugar most successfully at a temperature around

- A 10 °C.
- B 30 °C.
- C 100 °C.
- D 200 °C.

9.3 Gas **Y** is

- A carbon dioxide.
- B carbon monoxide.
- C hydrogen.
- D oxygen.

9.4 What is process **Z**?

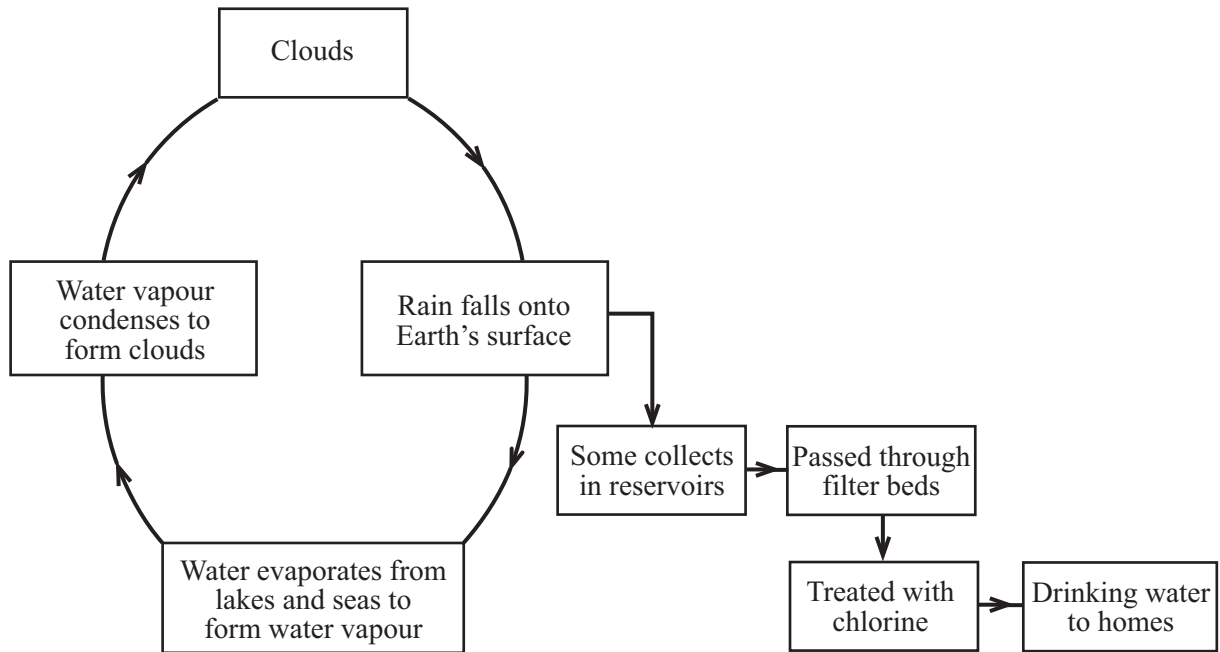
- A** Condensation
- B** Filtration
- C** Fractional distillation
- D** Precipitation

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

The diagram gives some information about the water cycle.



10.1 The thermal (heat) energy which causes water to evaporate from lakes and seas comes from

- A hot springs.
- B radioactive materials in the Earth's crust.
- C the Moon.
- D the Sun.

10.2 Rising water vapour condenses because

- A the pressure falls.
- B the pressure rises.
- C the temperature falls.
- D the temperature rises.

10.3 Water from reservoirs is passed through filter beds

- A to remove bacteria.
- B to remove calcium compounds.
- C to remove nitrate ions.
- D to remove solid particles.

10.4 Why is chlorine added before the water is supplied to homes?

- A To bleach the water.
- B To kill bacteria.
- C To remove dissolved solids.
- D To soften the water.

END OF TEST

You must do **one Tier** only, **either** the Foundation Tier **or** the Higher Tier.
The Foundation Tier is earlier in this booklet.

HIGHER TIER

SECTION A

Questions **ONE** and **TWO**.

In these questions match the words in the list with the numbers.

Use **each** answer only **once**.

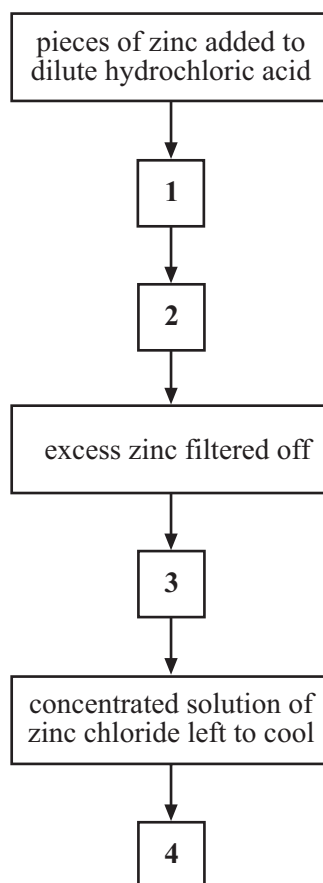
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QUESTION ONE

The flow chart shows stages in the preparation of the salt, zinc chloride.

Match sentences **Q**, **R**, **S** or **T** from the list with the numbers **1–4**, to explain how the salt can be made.

- Q** bubbles of hydrogen gas start to be given off
- R** extra zinc pieces added until no more will react
- S** solid zinc chloride crystallises out
- T** some water evaporated from the solution of zinc chloride



QUESTION TWO

This question is about organic compounds.

Match words from the list with the numbers 1–4 in the table.

ethyl ethanoate

melamine

poly(ethene)

polyvinylchloride

Substance	What we can say about the substance
1	it is a polymer that burns to produce carbon dioxide and water only
2	hydrogen chloride is produced when it burns
3	it is a thermosetting polymer, used in furniture
4	it is an ester

TURN OVER FOR THE NEXT QUESTION

Turn over ►

SECTION B

 Questions **THREE** and **FOUR**.

 In these questions choose the best **two** answers.

 Do **not** choose more than two.

 Mark your choices on the answer sheet.

QUESTION THREE

This question is about hard water.

 Which **two** of the following statements are correct?

chlorine removes hardness from water

dissolved sodium compounds make water hard

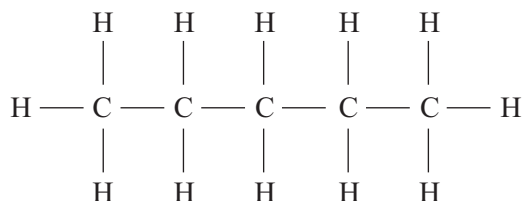
drinking hard water can reduce heart illnesses

hard water can be softened in an ion exchange column

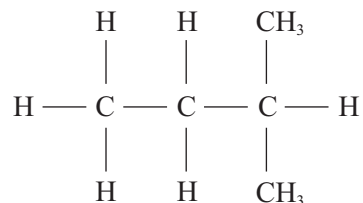
hard water can cause tooth decay

QUESTION FOUR

The diagram shows two isomers of a particular alkane.



Isomer M



Isomer N

 Which **two** statements about isomers **M** and **N** are correct?

isomer M has stronger forces between molecules

isomer N has stronger forces between atoms

isomer N has the higher boiling point

isomers M and N have the same chemical formula

only isomer M undergoes addition reactions

NO QUESTIONS APPEAR ON THIS PAGE

TURN OVER FOR THE NEXT QUESTION

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SECTION CQuestions **FIVE** to **TEN**.

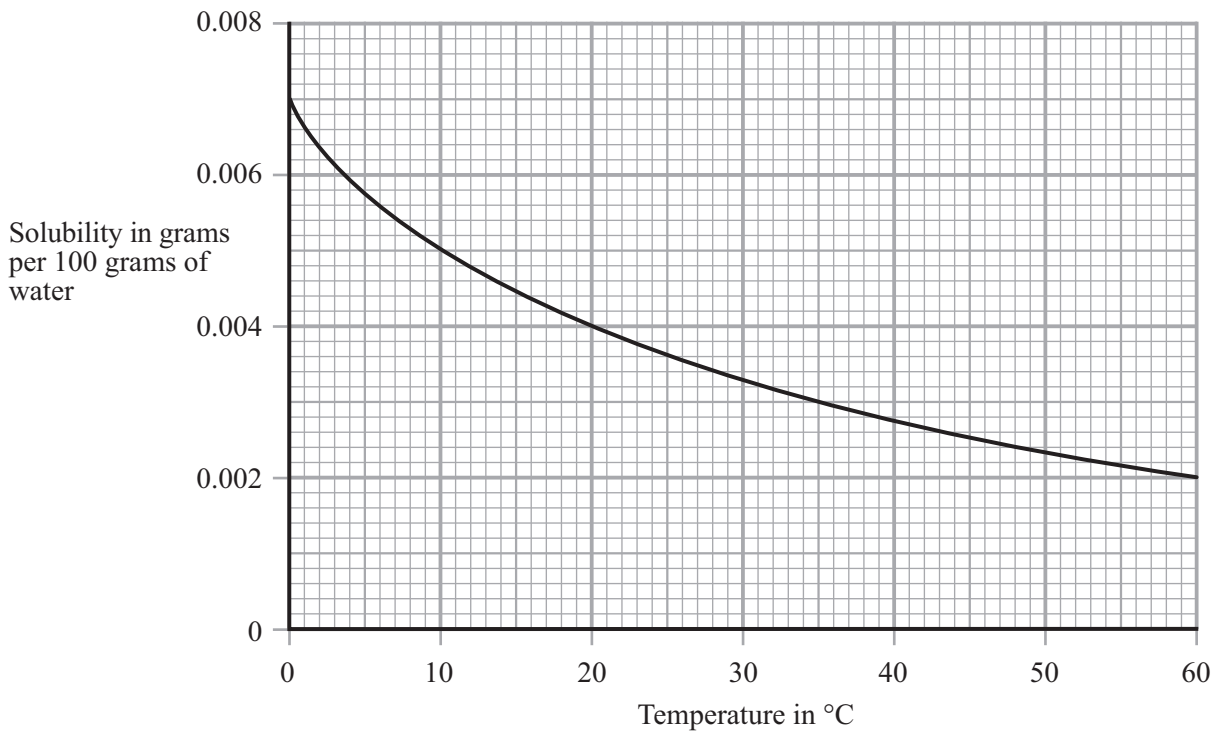
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QUESTION FIVE

The graph shows the solubility of oxygen in the temperature range from 0 °C to 60 °C

**5.1** What mass of oxygen will dissolve in 100 grams of water at 60 °C?

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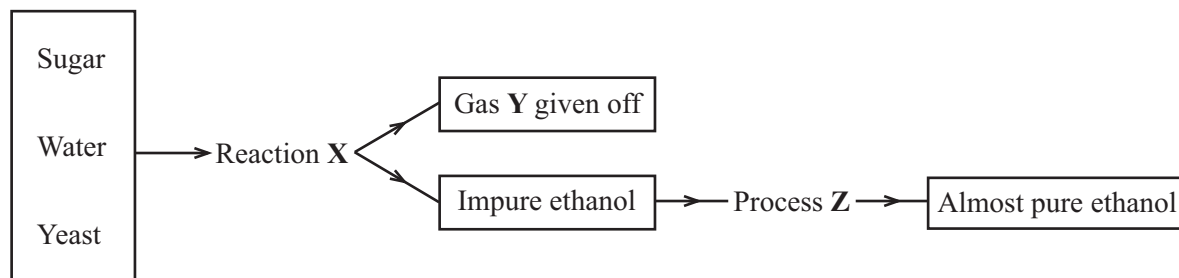
- A Increase the pressure
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6.2 The yeast works on the sugar most successfully at a temperature around

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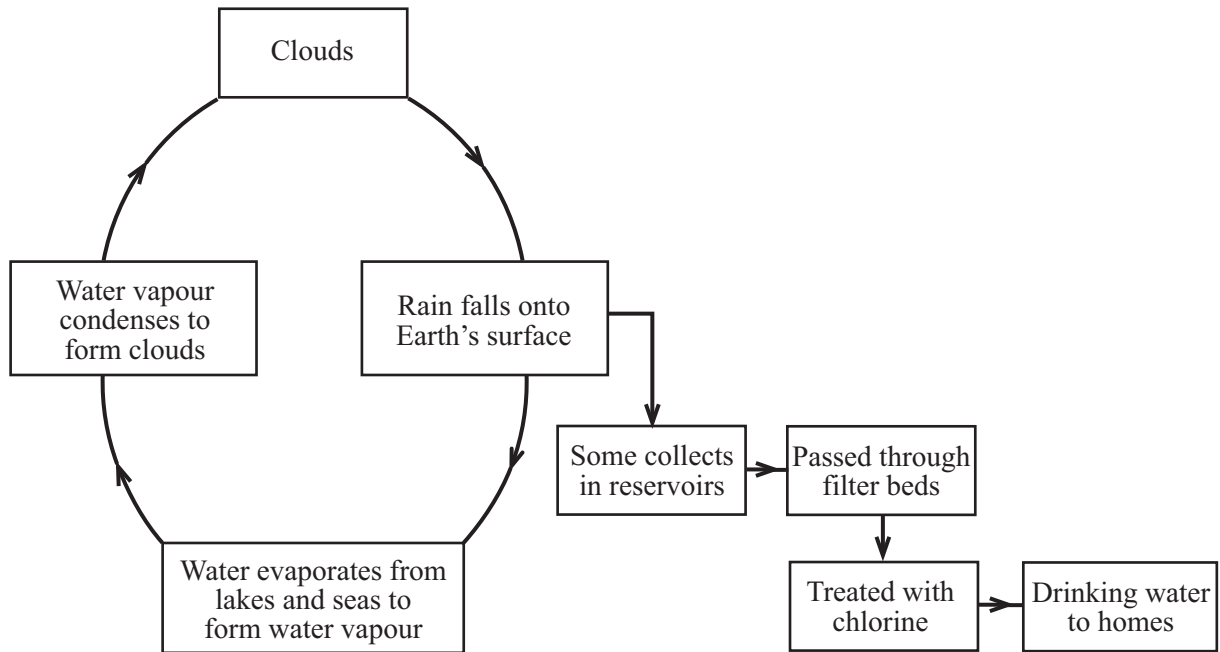
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Turn over ►

QUESTION SEVEN

The diagram shows some information about the water cycle.



7.1 The thermal (heat) energy which causes water to evaporate from lakes and seas comes from

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- A the pressure falls.
- B the pressure rises.
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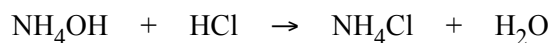
TURN OVER FOR THE NEXT QUESTION

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QUESTION EIGHT

Use the following information to help you answer parts of this question.

Relative atomic masses: H=1; N=14; O=16; Cl=35.5



A student does an experiment to find the volume of a 0.25 mol dm^{-3} solution of hydrochloric acid needed to exactly neutralise 25.0 cm^3 of a 0.10 mol dm^{-3} ammonia solution (ammonium hydroxide).

8.1 What method could the student use to find this exact volume?

- A Addition
- B Distillation
- C Precipitation
- D Titration

8.2 What volume of the hydrochloric acid solution is required?

- A 0.625 cm^3
- B 1.0 cm^3
- C 6.25 cm^3
- D 10.0 cm^3

8.3 What is the relative formula mass of ammonium hydroxide (NH_4OH)?

- A 34
- B 35
- C 80
- D 83

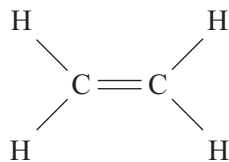
- 8.4** The number of moles in 25.0 cm^3 of a 0.10 mol dm^{-3} ammonia solution (ammonium hydroxide) is
- A** 0.00025 moles.
 - B** 0.0025 moles.
 - C** 0.25 moles.
 - D** 2.5 moles.

TURN OVER FOR THE NEXT QUESTION

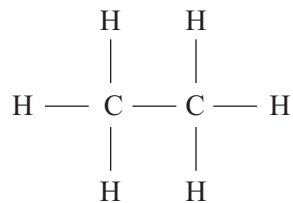
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QUESTION NINE

The diagrams show the structural formulae for two different hydrocarbons.



Hydrocarbon N

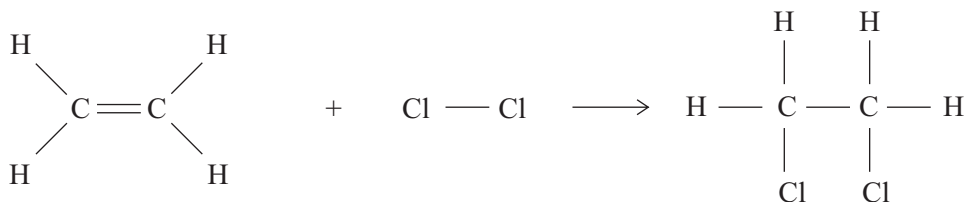


Hydrocarbon P

9.1 The homologous series to which hydrocarbon N belongs and the general formula for the series are

	Homologous series	General formula
A	alkanes	C_nH_{2n}
B	alkanes	$\text{C}_n\text{H}_{2n+2}$
C	alkenes	C_nH_{2n}
D	alkenes	$\text{C}_n\text{H}_{2n+2}$

9.2 The equation shows how hydrocarbon N reacts with chlorine.



What type of reaction is this?

- A Addition
- B Decomposition
- C Reduction
- D Substitution

9.3 Some vegetable oils react in a similar way with hydrogen.

An important product of such a reaction is

- A aspirin.
- B ethanol.
- C margarine.
- D vitamin C.

9.4 Hydrocarbon **P** will not react with chlorine in this way because

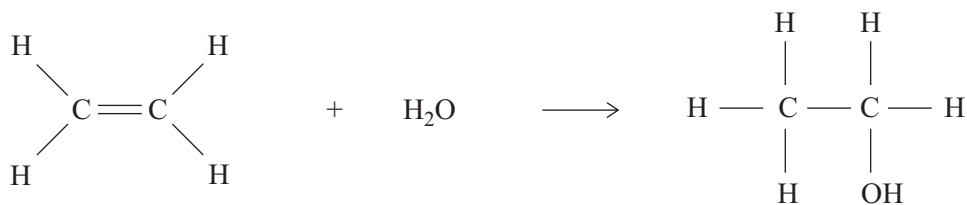
- A it does not have a carbon carbon double bond in its molecule.
- B it is an alkene.
- C it is unsaturated.
- D the carbon atoms in its molecules are linked by covalent bonds.

TURN OVER FOR THE NEXT QUESTION

Turn over ►

QUESTION TEN

The equation shows the reaction of ethene with steam.



10.1 The product of this reaction is

- A ethane.
- B ethanoic acid.
- C ethanol.
- D ethyl ethanoate.

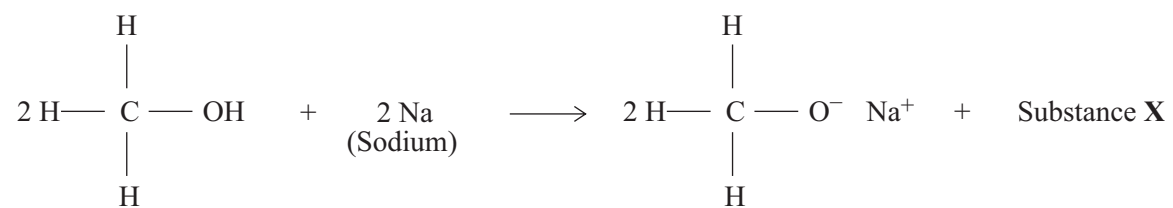
10.2 On a large scale, under what conditions is this reaction carried out?

	Temperature	Pressure	Catalyst
A	very high	very high	strong alkali
B	moderately high	very low	strong acid
C	moderately high	high	strong acid
D	very low	high	strong alkali

10.3 An ester is produced in a reaction between

- A a carboxylic acid and an alkali.
- B a carboxylic acid and carbon dioxide.
- C an alcohol and a carboxylic acid.
- D an alkene and a carboxylic acid.

10.4 The equation shows how an organic compound reacts with sodium.



Substance **X** is

- A carbon dioxide.
- B hydrogen.
- C oxygen.
- D water.

END OF TEST

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